Sources of skill in decadal predictions of Sahel precipitation

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The new, 40-member Large Ensemble of decadal predictions with the Community Earth System Model (CESM-DP-LE) shows considerable skill in predicting precipitation anomalies over the African Sahel region several years in advance. Such skillful predictions of the Sahel precipitation would provide decision makers with the ability to mitigate the impacts of a drought. Here, we assess the sources of this skill in the CESM-DP-LE through comparisons with its predecessor based on an earlier version of the CESM; its uninitialized Large Ensemble counterpart; persistence; and with observations. The relationships of Sahel precipitation with surface and upper tropospheric conditions are examined globally, but with a particular focus on regions and processes that have been previously identified as important for Sahel rainfall predictability. We first examine how skill in Atlantic SST associated with Atlantic Multidecadal Variability affects prediction skill for Sahel rainfall. We also investigate the influence of ocean-driven hemispheric SST asymmetry on the Sahel through application of an energetic framework that connects high latitude surface heat fluxes to tropical atmospheric overturning and precipitation. We then assess the role of atmospheric stability across the tropics and study whether improved representation of tropical tropospheric structure in the CESM-DP-LE is important. This connection to the upper troposphere may help to explain how long lead time skill in the tropical Indian and Pacific Oceans contributes to improved skill in predictions of Sahel precipitation.